Couette Cell Commissioned

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A new Couette cell for use on NCD stations has been constructed in a collaboration between the School of Chemistry at the University of Leeds and the NCD group.

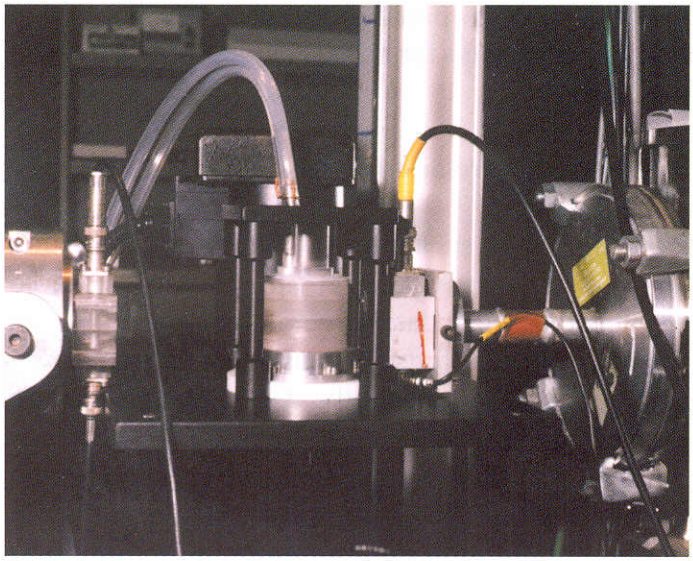

Figure 1: The Cell.

Figure 2: The Collaborators from left to right: John Pople, Ernie Komanschek, Ian Hamley, Mike Wardell and Greg Diakun.

This instrument has been designed for SAXS experiments on polymer and surfactant solutions or gels subjected to shear. It consists of a cylindrical outer rotor, machined from polycarbonate and an inner polycarbonate stator, which is cylindrical in the region through which the X-ray beam is incident, and tapered at the base. The sample gap is 0.5mm and approximately 3ml of sample is required to fill the cell. The rotor is driven by a programmable DC servo motor that can be operated in continuous or oscillatory mode. The motor is controlled from a PC. The user can specify shear rates in the range 0.05-1000s^{-1}, and for oscillatory shear the amplitude can be varied from 1 to 1800°. The system also comprises a refrigerated water bath for temperature control in the range 0-85°C. This is controlled from the software on the PC. The system was designed by John Pople, then working with Ian Hamley at the University of Leeds, and constructed in collaboration with Greg Diakun and Mike Wardell in the NCD group.

The capabilities of the instrument have recently been demonstrated on 8.2, where Ian Hamley and John Pople have been investigating the effect of shear on cubic phases formed in block copolymer and surfactant solutions. A representative diffraction pattern is shown in Fig.3. It was obtained from a gel of a poly(oxyethylene)-poly(oxybutylene) (EB) diblock copolymer in salt solution (0.2 M K_2SO_4, 30 wt% polymer) at room temperature, during continuous shear at a rate $\gamma = 100s^{-1}$. The relative position of reflections, in the ratio $1:\sqrt{2}:\sqrt{3}$, indicates a body centred cubic structure. The pattern prior to shear was unoriented, but steady shear leads to macroscopic orientation of the gel as shown by the presence of Bragg reflections. This orientation was found to be retained upon cessation of shear.

Colleagues interested in using the device should contact Ian Hamley (I.W.Hamley@chem.leeds.ac.uk, tel: 0113 233 6430) or Greg Diakun (G.Diakun@dl.ac.uk, tel: 01925 603343) for further details.

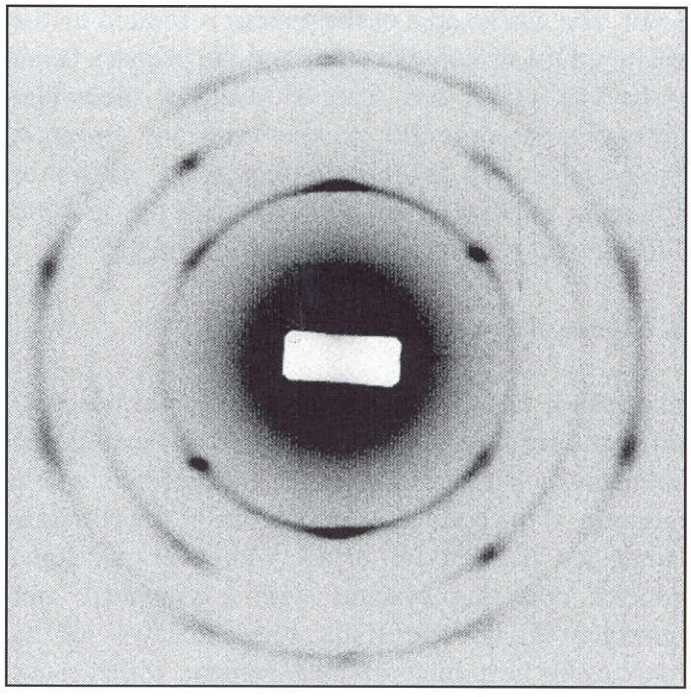

Figure 3: Diffraction pattern from a block copolymer gel oriented by steady shear.